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**File Code:** 3420 **Date:** August 26, 2004
**Route To:**

**Subject:** Bark Beetle Activity at IMAX Project Area (mogollonrimrd)

**To:** District Ranger, Mogollon Rim Ranger District, Coconino NF

On August 19, 2004, I traveled to Happy Jack to meet with Bruce Koyiyumptewa, District Silviculturist, to assess bark beetle activity in the IMAX project area on the Mogollon Rim RD, Coconino NF. I describe in this report bark beetle activity on the Coconino NF, summarize basic bark beetle biology and bark beetle activity within the project area, and make recommendations to minimize bark beetle impacts associated with this project area.

### *Bark beetle activity and biology on the Coconino NF*

Aerial detection surveys conducted by our Forest Health Protection zone office in 2003 found relatively high levels of bark beetle-killed ponderosa pine on the Coconino NF. A detailed summary of the aerial detection survey results for 2004 will be provided to the Forest at a later date; however, bark beetle-caused mortality of ponderosa pine was found on approximately 71,000 acres, totaling almost 2 million trees killed in 2003. This pine mortality is not unique to the Coconino NF. High levels of both ponderosa and piñon pine mortality have been documented across the state and throughout the Southwest over the last few years. Within many of these areas, ponderosa pine mortality is already greater than 25% for a given stand and as high as 90% in others. The vast majority of this pine mortality is related to the ongoing drought that the Southwest Region has been experiencing since 1996.

Inspection of fading trees and collected specimens determined that the pine engraver beetle (*Ips pini*) is the primary cause of ponderosa pine mortality on the Mogollon RD. This bark beetle is widespread throughout the West and can occasionally reach outbreak proportions (Kegley, et al., 1997). Most of the attacked trees show the characteristic fading from the top down associated with *Ips* attacks. A few of the pine with top kill also have western pine beetle (*Dendroctonus brevicomis*) and roundheaded pine beetle (*D. adjunctus*) in the lower portion of the trunks. Red turpentine beetle (*D. valens*) is present at the bases of almost all *Ips*-infested trees.

Pine engraver beetles. Adult pine engraver beetles attack smaller diameter trees and tops of larger trees; but their preferred host material is fresh pine debris from construction, logging, firewood cutting, or wind and snowstorms. Living trees can be attacked and killed once populations have built up in fresh pine debris. Two to three generations are produced per year. Adults emerge from overwintering material and fly to find new hosts in the spring (i.e., early April). Pine engraver beetles flights continue into the fall as long as daytime temperatures remain above 60° to 65°F. Generation time from egg to mature adult beetle ranges from one month to 8 weeks, with the shortest development time in mid-summer. Males initiate attacks and release chemicals which attract females. Adults build galleries (or tunnels), mate, and lay eggs. Galleries are distinctive. Typically, there is a central nuptial chamber (an enlarged area) from which several more or less linear adult galleries radiate.

Galleries slightly etch the sapwood, hence the common name, engraver beetle. Three or more egg galleries originate from the nuptial chamber in the shape of a tuning fork. Adult galleries are open and not packed with boring dust, in contrast to those of *Dendroctonus* beetles. Larvae (immature beetles) feed in their own galleries perpendicular to the adult galleries for a few weeks before pupating. Pupae turn into adults to complete the cycle. Evidence of attack includes fading foliage, red boring dust in bark crevices, and occasionally small pitch tubes on trunks of live trees. Because attacks are typically initiated near the tops of trees, the crown fades from the top down.

### *Bark beetle activity in the IMAX project area*

Bruce informed me that within the 20,000-acre IMAX project area, there were two thinning blocks of less than 1,000 acres each. The thinning prescription was thinning from below (trees less than 9 inches dbh were cut), with a maximum 20-foot spacing between trees. The thinning material was lopped and scattered or lopped and piled, depending on the site. Thinning treatments were designed to be completed during the late fall and early winter of 2003-2004; however, some of the areas were not completed until early April 2004.

Based on Bruce's earlier drive through of the thinning blocks, only the thinning area northeast of the Mahan Park ranch area had any residual tree mortality. Bruce and I observed approximately 100 pine trees on two to three acres that had been attacked by pine engraver beetles adjacent to Mahan Park. Approximately one-third of these pines had been attacked early in the summer as indicated by the complete fading (reddish-orange color) of all needles throughout tree crowns. The remaining trees were infested in mid- to late-summer and show the characteristic most fading at the top of the tree and least at bottom of the crown (top-down fading). Approximately ten of these trees had either western pine beetle or roundheaded pine beetle in the lower bole. Nearly all of the trees had red turpentine beetle at the base.

Based on removal of the bark from thinning slash in lop and scatter and lop and pile treatments, I concluded that pine engraver beetles had completed using this material for brood production. The exception was on the basal portion of larger diameter thinned trees, in which some fresh galleries were found.

## *Recommendations*

I provide here general preventive measures for future fuel reduction/thinning projects and then provide more specific recommendations for the IMAX project area. Most of this information is included in the Integrated Pest Management Guide for *Ips* species attacking ponderosa pine (Parker 1991).

In general, population increases of pine engraver beetle can be minimized by implementing thinning projects after the onset of the monsoon season through December. Cutting trees during this season will allow the material to partially dry out before beetles fly in the spring. Also, standing residual trees may be less susceptible during this time due to increased soil moisture caused by the monsoon rains. Slash generated from January through May typically remains moist and enhances beetle population increases. While this is a good general recommendation when beetle populations are relatively low, we have observed pine engraver beetles to complete at least one generation in slash generated during the fall of 2002 and 2003 on most Forests in Arizona. If this timing approach is being used, and trees are only lopped and left untreated on

the site, there are a couple of points to consider. First, slash generated on more exposed areas that have relatively low residual basal area will likely dry out more by the time beetles fly in the spring. Second, on steeper slopes or where the residual basal area is still relatively high, slash may not adequately dry out by the time beetles fly in the spring.

Another general "rule of thumb" approach to preventing pine engraver beetles from impacting areas where thinning projects are being implemented is to separate project areas in time and/or in space. Beetle populations probably will remain relatively low if thinning projects are conducted every other year. Similarly, a buffer of over 2 miles between management sites is also thought to prevent mass movement of beetles from one area to another. This is important information to keep in mind for ongoing thinning treatments in the IMAX area, especially if an additional 1,000 acres are to be treated beginning in the fall of 2004 or early 2005. If thinning treatments are implemented in consecutive years, there likely will be a buildup of pine engraver beetles that can move from one thinning project to the next. This scenario somewhat resembles an approach used in the northern Rocky Mountains where pine engraver beetles populations are regulated through "green chaining." As long as there is new and suitable slash, the beetles stay in this material and do not severely impact thinned stands. However, if the slash food supply is cut off, the beetles may move into standing trees. I would caution against this approach in Arizona, as there can be numerous factors that may result in the "breaking of the chain."

The best preventive strategy to minimize pine engraver beetle activity relative to thinning projects and associated slash is to utilize the larger diameter slash. Harvesting most ponderosa pine slash larger than 4 inches in diameter will help to prevent beetle populations increases, because few beetles are produced in slash less than 4 inches since this material dries out quicker and there can be more competition for less food. The larger diameter slash should be removed from the site or treated (chipped) within 28 days of being generated if thinning occurs during active beetle flight periods (April through early October). If thinning occurs during November through March, the larger diameter material should be removed or treated before the time beetles complete their first generation in the spring (i.e., by early May). If slash does become infested in April, removing or treating the newly infested material may aid in reducing the local population of pine engraver beetles.

Also, I would like to add a word of caution about chipping fresh slash. Although no experimental studies have been conducted to examine the relationship between chipping and bark beetle attraction, we do know that bark beetles are attracted to host tree compounds such as terpenes. Fresh-cut trees and chips release high quantities of terpene volatiles that can attract bark beetles. To minimize the potential of chips attracting bark beetles, chips should be kept in sunny areas as much as possible rather than in shaded areas or be removed from the site. Try to prevent piling the chips at the bases of pine trees. If the chips are kept out in the sun, they will dry quickly and, therefore, stop emitting terpene volatiles. Chipping during autumn through early winter probably has less risk than chipping at other times of the year.

I recommend that residual trees currently infested with beetles be cut and removed from the site or treated on site as soon as possible. Pine engraver beetle brood will likely complete their development within the next few weeks and then seek overwintering sites. Therefore, treating these infested trees will help to reduce the local beetle population. Obviously, once the beetles have emerged from these trees, cutting them will not reduce beetle populations. Examples of on-site treatments include: cut and burn on site, cut and bury at least 6 inches deep on site, cut and

chip, or cut and debark. When burning infested trees or slash, the material does not need to be entirely consumed; only the outer bark and cambium needs to be charred significantly enough to kill the developing brood. The use of a terra torch has been proven effective at treating infested green slash piles.

It will be important to keep an eye on the residual trees within areas to be thinned in the near future. If residual trees are observed to begin fading, prompt cutting and treatment of these trees will help to reduce the buildup of pine engraver and other bark beetle populations. However, using the slash management guidelines outlined above is a better preventive strategy.

Funds may be available for FY2005 from Forest Health Protection to deal with bark beetle activity. Requests for these funds should be in no later than October 22, 2004. Please have your staff contact our office if funding will be requested.

If you have any questions regarding my assessment of bark beetle activity within the project area, its potential effect on residual standing trees, or my recommendations, please let me know. I can be reached at (928) 556-2074.

/s/ Joel D. Mcmillin
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cc: Bruce Koyiyumptewa, John Anhold, Debra Allen-Reid, Leonard Lucero, Larry Sears, Mailroom R3 Coconino